United States Patent [19]

Bernaldo

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[54] **METHOD FOR REPAIR OF PLASTIC-CASED BATTERIES**

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[52] **U.S. Cl.** **136/174**

[51] **Int. Cl.²** **H01M 10/54**

[58] **Field of Search** 136/174

[56] **References Cited**

UNITED STATES PATENTS

2,398,275 4/1946 Alpert 136/174

3,283,637 11/1966 Brenner et al. 136/174

FOREIGN PATENTS OR APPLICATIONS

1,374,016 11/1974 United Kingdom 136/174

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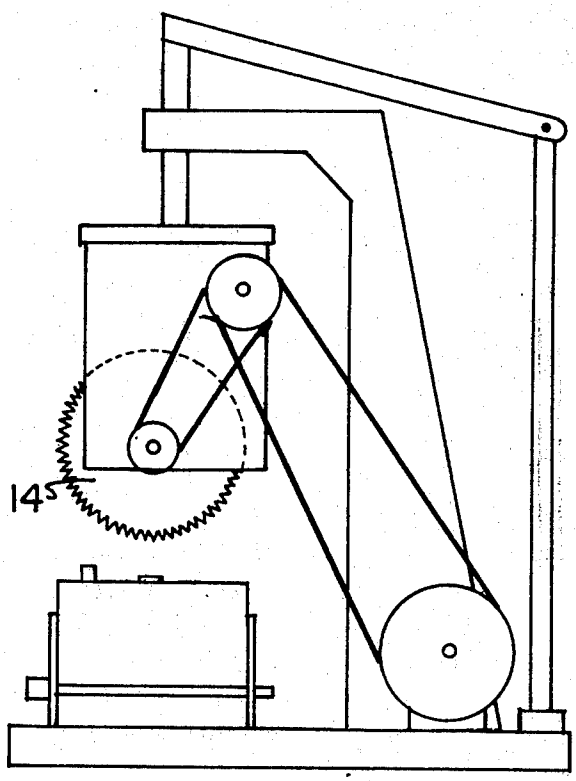
[57] **ABSTRACT**

A method for removing and replacing a portion of the sealed top of a defective plastic-cased automotive or marine battery for the purpose of repair of defective cell or cell-connectors.

2 Claims, 6 Drawing Figures



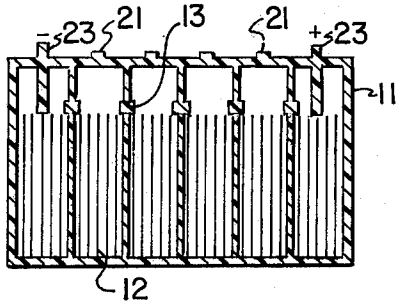


FIG. 1

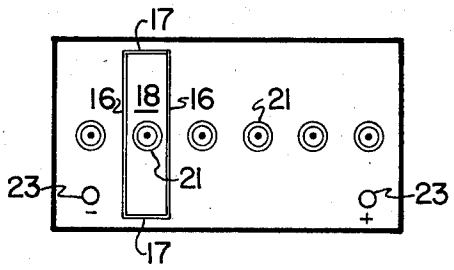


FIG. 2

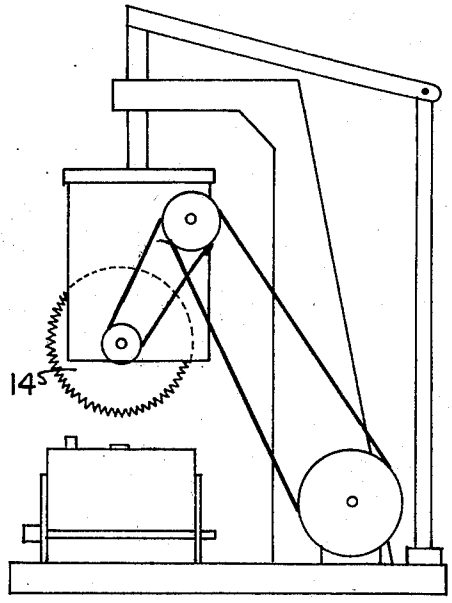


FIG. 3

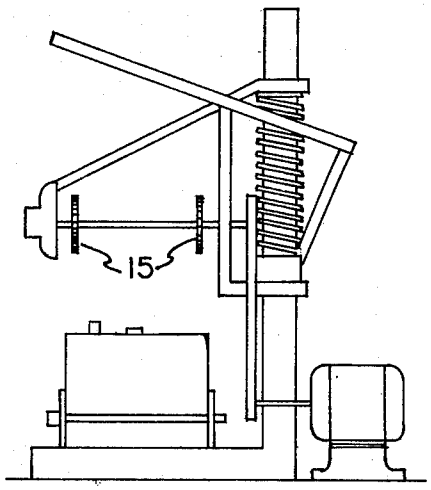


FIG. 4

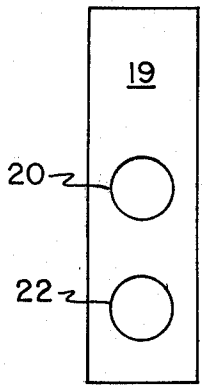


FIG. 5

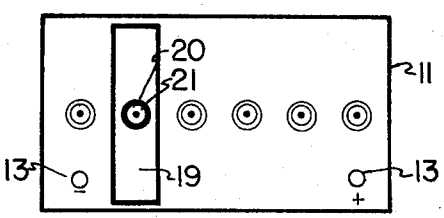


FIG. 6

METHOD FOR REPAIR OF PLASTIC-CASED BATTERIES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is associated with the field of automotive and marine battery technology, specifically as related to the repair of such devices to allow economical additional use thereof.

2. Description of the Prior Art

Previous battery construction techniques involved the use of an asphalt-sealed cover plates. The method of sealing facilitated straight-forward repair of batteries by means of heating the asphalt seal for removal of the cover plate to gain access to a defective cell. Following cell repair by removing, repairing, and replacing the cover and the cell, the asphalt seal was easily reformed.

Present-day manufacturing techniques have eliminated the asphalt seal through the use of a complete plastic casing to provide improved moisture resistance. However, the elimination of the asphalt seal also precluded ready access to the battery interior for repair purposes, resulting in the wasteful practice of battery replacement rather than the economical practice of battery repair.

Therefore, it is an object of this invention to achieve an economical and effective repair method suitable for plastic-cased batteries.

SUMMARY OF THE INVENTION

One of the primary failure modes for battery cell failure is not related to the degradation of the lead component of the cell, but is due instead to a defect in the cell-to-cell electrical connection. Such connections are made internally, and are readily accessible only if the battery cover can be removed in the area of interest.

Therefore, in achieving the object of a method for economical and effective repair of plastic-cased batteries, the first step is to provide access through the top of the battery by means of cutting open and removing the top cover section corresponding to the defective cell (or cells). During the cutting operation, to prevent contamination of the battery interior by particulate matter generated by the cutting process, a vacuum hose attachment located next to the cutting edge is used to remove such particulate matter.

The next step is to repair the defective cell; in the common case of a defective electrical connection by means of rebonding or replacing the connection.

The third step is to bond the removed top cover section of the defective cell to a cover plate which is larger than said removed top cover section and which contains hole cutouts to accomodate the cell cap and, if required, the battery terminal post.

The final step is to bond in place on the cut area the removed cover section with attached cover plate, the cover plate overlapping the cut area to provide a fluid seal.

The bonding agent used in the repair process is preferably an epoxy-type compound.

The cover plate may be manufactured by cutting or stamping to appropriate dimension sheet plastic of a type similar to that used in construction of batteries.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is the side view of the cross-section of a six-cell battery.

FIG. **2** is the top view of the battery showing the cuts over a defective cell.

FIG. **3** illustrates a cutting means for use in removing the top of a battery cell.

FIG. **4** illustrates a second cutting means for use in removing the top of a battery cell.

FIG. **5** is a cover plate for use in re-sealing a repaired battery cell.

FIG. **6** is a top view of a repaired battery.

DETAILED DESCRIPTION

FIG. **1** depicts a cross-sectional view standard six-cell automotive or marine battery **11** constructed using a plastic case with plastic cell partitions and a one-piece plastic cover. It is assumed in this discussion that cell **12** is defective. The defect may or may not be a defective electrical connection between cells caused by defective connector **13.**

Previously, the standard practice of manufacturers and users of batteries has been to discard a battery with a defective cell, regardless of whether the defect was minor or major in nature.

The process of this invention attains access to the defective cell **12** by utilizing a cutting means **14** and **15** to open the top of cell **12** along lines indicated in FIG. **2.** Preferably the cutting means **14** and **15** consists of two pairs of rotating circular cutting blades. In practice it has been determined that hardened steel saw blades with moderately fine tooth size are adequate for performance of the cutting task. It has been found that one pair consisting of two eight-inch blades is suitable for making cuts **16** as indicated in FIG. **3.** The other pair of rotating blades are preferably two inches in diameter and are used to make shorter cuts **17,** as also indicated in FIG. **4.**

The cutting means **14** and **15** are preferably mounted on a suitable framework of movable rotating shafts and pulleys mounted in relation to a conveyer belt or roller table such that with the battery in proper position the cutting blades will make the proper cuts with one downward motion for each pair rotating blades. The method of construction of cutting means **14** is well-known to those skilled in the art pertaining to the design of machine-shop equipment.

The battery cell **12** is drained of acid prior to being cut open and a vacuum attachment may be used with cutting means **14** to minimize particulate contamination of the cell.

Cell repair is accomplished according to the various methods of repair which are well-known to those skilled in the art of battery repair. In certain cases it may be necessary to drill a hole in the top of an adjacent cell for the purpose of repairing the electrical connector between cells.

Upon completion of the repair of the defective cell **12,** the removed top section **18** is replaced by first bonding said top section **18** to a cover plate **19,** which may be cut or stamped from a sheet of acid-proof polypropylene plastic. Cover plate **19,** shown in FIG. **5,** must be larger in dimensions than top section **18** and may be provided with a hole **20** positioned and sized to allow cap **21** to protrude through said hole **20,** at the same time extending beyond the edges of top section **18** a distance of approximately one-fourth to one-half

inch. When necessary, cover plate **19** may be provided with a second hole **22** for the purpose of allowing battery terminal **23** to protrude.

The final step of the repair is the bonding of cover plate **19** with attached top section **18** to battery cell **12** with top section **18** substantially in its original position. The cell is refilled with acid and the bonding process is checked for leaks.

In practice it has been found that an epoxy type of glue may be used for the bonding process.

It is understood that the process of this invention is not limited to the precise method set forth but that it includes within its purview whatever charges fairly come within the terms of spirit of the appended claims.

I claim:

1. A method for removing and replacing a portion of the sealed top of a defective automotive or marine battery for the purpose of repair of defective cells or cell connectors comprising

a. Starting with

i. A sealed battery with defective cell or cell connector,

ii. A pair of larger parallel rotating circular cutting blades displaced from each other a distance less than the width of said defective battery cell,

iii. A pair of smaller parallel rotating circular cutting blades displaced from each other a distance less than the length of said defective battery cell,

iv. A cover plate, and

v. A bonding means;

b. Removing fluid from the battery cell;

c. Placing the defective cell of the battery under one pair of rotating circular cutting blades and causing said blades to cut slots on opposite two of the four sides of the top of said defective cell;

d. Placing the defective cell of the battery under the other pair of rotating circular cutting blades and causing said blades to cut slots on the remaining two of the four sides of the top of said defective cell;

e. Removing the top of said defective cell for the purpose of repair;

f. Accomplishing said repair;

g. Bonding the top of said defective cell to a cover plate;

h. Bonding said cover plate with attached defective cell top to the battery in a manner which reseals the formerly defective cell; and

i. Refilling the battery cell with fluid.

2. The method of claim **1** wherein said parallel rotating circular cutting blades are used in conjunction with a vacuum device for removing particulate matter resulting from the cutting operation.

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